No. 679,155. Patented July 23, 1901.

J. J. MONTGOMERY.

CONCENTRATOR.

(Application filed June 6, 1900.)

(No Model.)

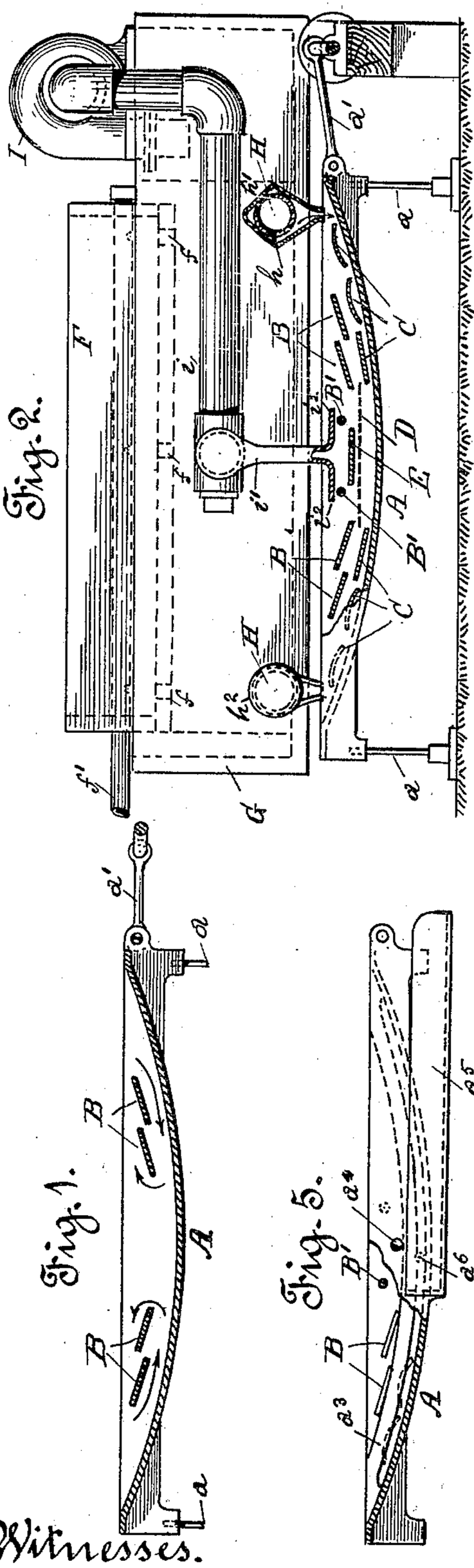

Fig. 2.

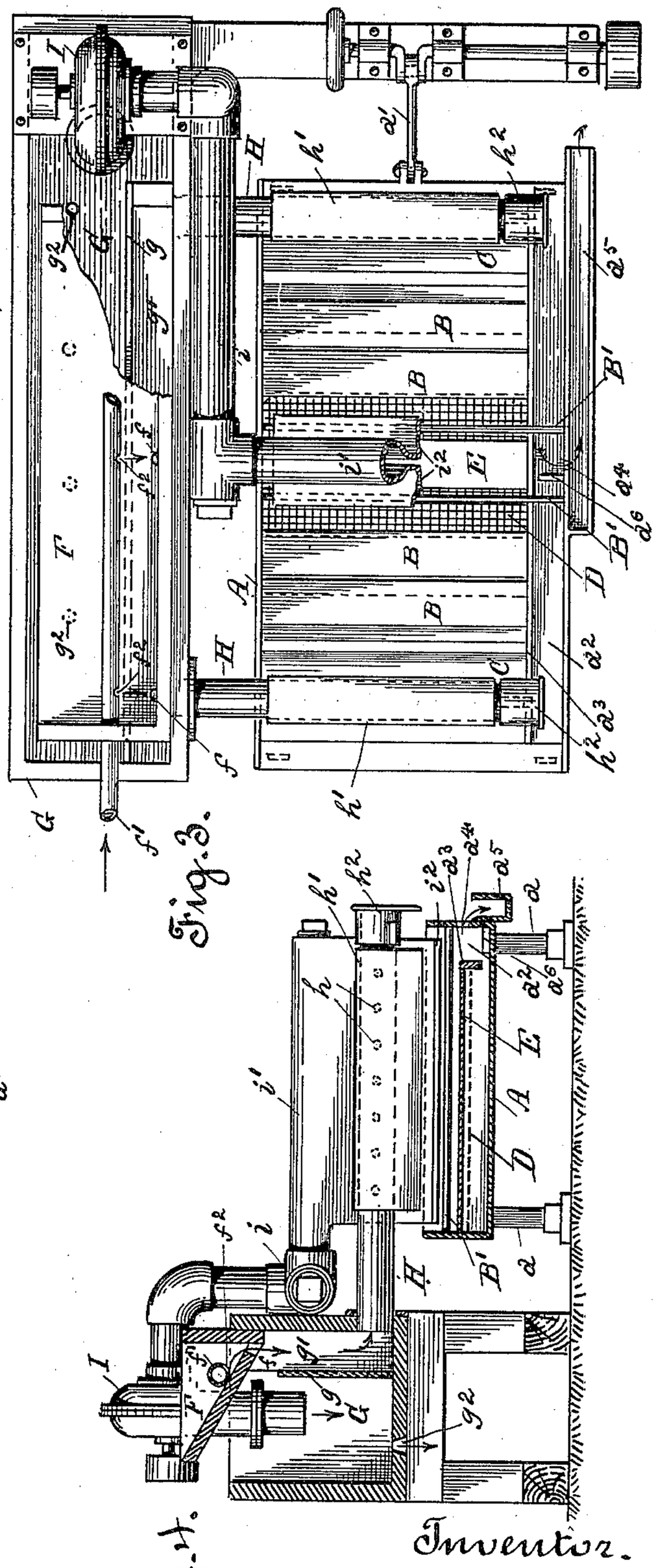

Fig. 3.

Fig. 1.

Fig. 5.

Fig. 4.

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CONCENTRATOR.

SPECIFICATION forming part of Letters Patent No. 679,155, dated July 23, 1901.

Application filed June 6, 1900. Serial No. 19,261. (No model.)

To all whom it may concern:

Be it known that I, JOHN J. MONTGOMERY, a citizen of the United States, residing at Santa Clara, in the county of Santa Clara and State of California, have invented certain new and useful Improvements in Concentrators; and I do hereby declare the following to be a full, clear, and exact description of the same.

My invention relates to the class of concentrators especially adapted for separating the precious particles from sand.

It consists in the novel separating-table, which I shall fully describe; and it consists also, in connection with a separating-table, of means for supplying it with sand and water and for withdrawing the water and lighter material from the table and resupplying the water thereto.

It also consists in details of construction, arrangement, and combination, which I shall hereinafter describe and claim.

The object of my invention is to provide a simple and efficient concentrator for economically separating the precious particles from sand.

Referring to the accompanying drawings, Figure 1 is a vertical longitudinal section of a concentrating-table, illustrating the effect of the current-producers B B. Fig. 2 is a front elevation, partly in section, of my concentrator. Fig. 3 is a plan of same. Fig. 4 is an end elevation, partly in section. Fig. 5 is a side elevation, partly broken, of the table.

Referring first to Fig. 1, A is a table so dished or otherwise formed or flanged as to hold water. This table is mounted in such manner that a longitudinal vibration may be imparted to it. For this purpose it may be mounted upon spring-supports *a* and a crank connection, such as *a'*, made with it to give it the necessary end shake. Secured to the table and lying transversely above its bottom are strips B, which I may call "current-producers." These are inclined to the surface of the table-bottom, and according to their direction of inclination—that is to say, whether they incline upwardly to the right or to the left—so will be the direction of the current produced in the body of contained water. The strips operate according to the following principle: If two planes be placed at an angle and vibrated in a fluid, a current will be set up between the planes toward the vertex of the included angle, it being immaterial whether the vibration is in a line with either plane. In accordance with this principle when water is contained in a shaking pan or table or when said pan or table is immersed in water, said pan or table having above its bottom and within the body of water a cross-strip, such as B, inclined to the surface of said bottom, a circulatory current will be produced in the water the direction of movement of which will depend upon whether the vertex of the included angle between them be toward the right or toward the left. I have found that the direction of the current below the strip will be toward the lower edge of said strip—viz., toward the vertex of the included angle—and above it the current will flow toward the upper edge, and this I have indicated by the arrows in Fig. 1. If now sand sufficiently mixed with water to enable it to follow the laws of fluid movements be supplied to the shaking-table A, it will by the currents produced by the strips B be caused to positively (and either independently of or in connection with gravity) move along the table-bottom in the direction desired—as, for example, in Fig. 1, toward the center. This applies also to a level table with a plane bottom or one set at an incline as well as to the one shown, which for the sake of illustration is shown as sloping from each end toward the center. These strips B, in connection with the table-surface, produce three distinct effects—to wit, first, a disturbance in the water due to a whipping movement; second, a current as a resultant of this disturbance, and, third, a jumping movement of the sand.

Referring now to other figures, I show the application of this principle in connection with other parts, which go to form a more efficient means of concentration or separation. A is the same table, with its arrangements for having vibration imparted to it and carrying the same current-producer strips B. In the table at each end are riffles C, which consist of separated strips raised slightly above the bottom and preferably some curved to present as a whole an undulatory or waving surface and some flat, as shown. The riffles continue down the table as far as desired and are joined by a screen or other per-

forated diaphragm D at the middle, which lies above the table-bottom. At the center of this screen is a narrow plate E. The parts—to wit, riffles C and screen D—form what may be termed a "semipartition" between the current-producers B and the table-bottom.

F is a hopper to which the sand and water are supplied. The hopper has exits *f* in its bottom. The hopper is supported above a trough G, which at one side has a partition *g*, forming a chamber *g'*, into which the sand and water pass from the hopper-exits *f*. With this chamber *g'* the delivery-pipes H communicate, and said pipes are adapted to discharge the sand and water upon the riffled ends of the table A. Within the trough is a centrifugal or other pump, (indicated generally by I.) This pump connects at one side with and is adapted to discharge water into the trough G. At its other side it connects with a pipe *i*, from which extends a suction-pipe *i'*, which projects over the table A and into the water therein directly above the cross-plate E.

Before entering upon a description of details it will be best at this point to describe the operation of these general features. The sand and water delivered from pipes H to the riffles C of the vibrating table A are immediately so agitated and affected by the currents flowing in said table by reason of the strips B, as heretofore mentioned, that the heavier portions—the concentrates—sink to the bottom or lower levels and are further separated by the riffles between and below which they pass, while the lighter stratum above, such as the worthless sand, moves above the riffles toward the center. The concentrates pass under the screen D, while the lighter sand passes above it. The screen serves as one of its functions to break up at this point the circulatory current created by the strips B or to sufficiently interfere therewith so that the concentrates and light sand remain in their relative positions.

The screen, together with the riffles, forms, as I have said, a semipartition between the currents above and the concentrates on the table-bottom. This partition serves a fourfold purpose: First, it produces a mild agitation in the body of sand; second, it offers a partial screen by which the concentrates are protected from the powerful action of the inclined planes B above; third, it affords a means by which the heavy particles are sifted down at the point of supply and of an upward sifting of the lighter particles as the sand approaches its point of stoppage and gradually increases in depth, and, fourth, it retards the flow of sand due to gravity or other causes, just as obstructions in the bottom of a stream retard its flow. In this action it tends to localize the point at which the precious metal is gathered. Now by means of the suction-pipe *i'* the light sand and water, the latter having its current partly broken by plate E, are taken up and passed through the pipe *i* and pump I into the trough G. In the trough the level of the water is raised by the action of the pump, so that clear water passes over the partition *g* therein and into chamber *g'* and, mixing with the fresh entering water and sand, is once more carried to the table A to be circulated again. The worthless sand in the trough is discharged through exits, such as g^2, in the trough-bottom.

The suction-tubes while intended, primarily, to draw off the sand may with advantage be so formed as to aid in bringing the sand to the point of suction or escape. In this formation the lips or lower ends of the suction tubes or pipes *i'* are formed with flanges i^2. These flanges cause a strong stream to flow over the sand, by means of which sand is piled up under the points of suction, thus preventing the influence of suction extending too deep and drawing off the concentrates not sufficiently protected by the semipartition. As a means of aiding the lateral currents under the flanges the system of inclined planes, such as the strips B, may be extended under these flanges. By this means the sand is whipped up and is carried along rapidly by the currents. That portion of the inclined-plane system which is under the flanges may with advantage be composed of small rods (indicated by B') instead of inclined surfaces, such as B, their only office being to whip up the surface of the sand, while the current toward the suction-tube carries it along and off.

A clean-up of the concentrates may be had in any suitable way. In case it be desired to have an automatic and constant discharge of the concentrates the table A is given a slight lateral inclination, whereby its contents will flow down to one side, where a passage-way a^2 is provided. Separating this passage-way from the body of the table is a barrier a^3, raised above the table-bottom, thereby permitting the concentrates to pass under it, while water may flow over it. In the side of the table is made an exit a^4 at a level high enough to permit the water to carry off the concentrates lying in passage-way a^2 and deliver them to a side trough a^5, from which they may be delivered in any manner desired. In the bottom of the passage-way a^2, in the neighborhood of the exit a^4, is a rib a^6, which produces sufficient agitation (due to the movement of the whole table) in the concentrates and water to enable the latter to effectually carry off the former through the exit. Sand, even when mixed with considerable water, does not flow readily enough to prevent clogging in the discharge-holes, particularly where the mixture of the sand and water takes place at some distance from the exit. To avoid this difficulty in the feed of the material, I place in the hopper F a water-pipe *f'*, which, directly opposite the exits *f* therein, has a hole f^2. A stream or jet of water from these holes is sufficient to dissolve, as it were, any clogging mass of wet

sand and cause it to flow freely through the exits, which are thus kept constantly free and open.

In order to provide for a gentle delivery of the material from the pipes H to the table, I so connect said pipes with the trough G that they may be axially turned, thereby providing for turning these discharge-holes *h* to any angle found best. Further, to insure this result of gentle delivery I hang upon each pipe an open-bottomed shield or loose guard-sleeve *h'*, which breaks the force of the falling material. Also upon the end of pipe H, I fit a rotary damper or valve cap h^2, which by its movement controls the capacity of the end of the pipe, thus checking and regulating the flow therethrough.

It is obvious that the concentrator may be increased in capacity by extending the length of the table and supply-trough and multiplying the several devices.

The same effect of producing the circulatory currents, heretofore described, would follow the immersion of the table and its parts in a body of water instead of so shaping the table as to contain a body of water.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. A concentrator, comprising a table, having means for vibrating it, and strips lying transversely above and removed from the bottom of the table and immersed in the water on the table, and accompanying said table in its vibration, the under faces of said strips being set at an inclination to the surface of the table-bottom and uniformly disposed in sets, whereby circulatory currents of given direction are produced in the water upon said table.

2. A concentrator, comprising a table, shaped to contain a body of water, means for vibrating the table, and strips lying transversely above and removed from the bottom of the table, and accompanying said table in its vibration, said strips being immersed in the body of water on the table, and having their under faces set at an inclination to the surface of the table-bottom and uniformly disposed in sets, whereby circulatory currents of given direction are produced in the water upon said table.

3. A concentrator, comprising a table, means for vibrating the table, strips lying transversely above and removed from the bottom of the table, and accompanying said table in its vibration, the under faces of said strips being set at an inclination to the surface of the table-bottom, and said strips being immersed in the water on the table, whereby circulatory currents of given direction are produced in the water upon said table, a transverse perforated diaphragm carried by the table above its bottom and below the horizontal plane of the transverse strips, and means for discharging the gangue.

4. A concentrator, comprising a table, means for vibrating the table, strips lying transversely above and removed from the bottom of the table, and accompanying said table in its vibration, said strips being set at an inclination to the surface of the table-bottom whereby circulatory currents of given direction are produced in the water upon said table, separated riffle-strips carried by the table above its bottom, and below the transverse strips, a transverse perforated diaphragm also carried by the table above its bottom and below the horizontal plane of the transverse strips, said riffles and diaphragm forming a semipartition between the inclined strips and the table-bottom, and means for discharging the gangue.

5. A concentrator, comprising a separating-table, a feed-trough formed with two compartments communicating at or near the top, means for feeding sand and water to one of said compartments, delivery connections from said compartment to said separating-table, and a suction device and connection arranged to withdraw the lighter sand and water from the separating-table and deliver the same into the other compartment of the feed-trough where they are separated and the water delivered to the first-mentioned compartment, substantially as described.

6. A concentrator comprising a separating-table, a feed-trough divided by a partition into two compartments communicating above said partition, a hopper above said trough arranged to deliver sand and water to one compartment of the trough, delivery connections from said compartment to said separating-table, a suction-pipe above the separating-table, a pump connected therewith for drawing off the lighter sand and water, and a discharge-pipe from the pump to said other compartment of the trough, substantially as described.

7. The combination, in a concentrator, of a separating-table, to which the sand and water are fed, a trough having a feed-chamber, with delivery-pipes to supply the sand and water to the table, a feed-hopper with exits communicating with and adapted to supply the sand and water to the feed-chamber, suction-pipes to withdraw the lighter sand and water from the table, a pump connected with said pipes, to effect the suction, said pump having a discharge into the trough, exits from the trough for the sand, and a communication in the trough for permitting the water therein to pass into the feed-chamber thereof, to be redelivered to the table.

8. In a concentrator, the combination of a vibrating table, having transverse strips above and removed from its bottom and immersed in the water upon said table, said strips being set at an inclination to the surface of the table-bottom and uniformly disposed in sets and adapted to effect circulatory currents in the water on the table, whereby the separated particles are moved to given points, and suction devices above said points,

adapted to withdraw the water and lighter material from the concentrates.

9. In a concentrator, the combination of a vibrating table, having transverse strips above and removed from its bottom and immersed in the water upon said table, said strips being set at an inclination to the surface of the table-bottom, the inclination of the strips on opposite sides of the central portion of the table being opposite and adapted to effect circulatory currents in the water on the table, whereby the separated particles are moved to the central portion of the table, and suction devices above said points, adapted to withdraw the water and lighter material from the concentrates, said suction devices consisting of a suction-pipe with base-flanges and a pump connection with said pipe.

10. In a concentrator, the combination of a vibrating table, having transverse strips above and removed from its bottom and immersed in the water upon said table, said strips being set at an inclination to the surface of the table-bottom and adapted to effect circulatory currents in the water on the table, whereby the separated particles are moved to given points, and suction devices above said points, adapted to withdraw the water and lighter material from the concentrates, said suction devices consisting of a suction-pipe with base-flanges and a pump connection with said pipe, and agitating-rods moving with the table and located below the base-flanges of the suction-pipe.

11. In a concentrator, the combination of a vibrating table, having transverse strips above and removed from its bottom and immersed in the water upon said table, said strips being set at an inclination to the surface of the table-bottom, the strips on opposite sides of a central portion of the table having an opposite inclination and adapted to effect circulatory currents in the water on the table, whereby the separated particles are moved to a substantially central portion of the table, a trough having a feed-chamber with delivery-pipes, to supply the sand and water to the table, suction-pipes above the said central portion of the table to which the material has been directed by the circulatory currents and adapted to withdraw the lighter sand and water from the table, a pump connected with said pipes, to effect the suction, said pump having a discharge into the trough, exits from the trough for the sand and a communication in the trough, for permitting the water therein to pass into the feed-chamber thereof, to be redelivered to the table.

12. In a concentrator, the combination of a vibrating table, having the separated riffles and perforated diaphragm, forming a semi-partition, as described, and the transverse inclined strips for effecting circulatory currents, as described, whereby the separated particles are moved to given points, a trough having a feed-chamber with delivery-pipes to supply the sand and water to the table, suction-pipes above the points to which the material has been directed by the circulatory currents and adapted to withdraw the lighter sand and water from the table, a pump connected with said pipes, to effect the suction, said pump having a discharge into the trough, exits from the trough for the sand, and a communication in the trough for permitting the water therein to pass into the feed-chamber thereof, to be redelivered to the table.

13. In a concentrator, a separating-table laterally inclined, and having a passage-way at its lower side, a raised barrier-strip on the upper side of the passage-way, an elevated exit in the table side, and an agitating-rib in its bottom, substantially as described.

14. In a concentrator, and in combination with a separating-table, a delivery-pipe for the material said pipe having discharge-openings, and an open-sided sleeve surrounding said pipe, the open side thereof being out of registration with said discharge-openings, substantially as described.

15. In a concentrator, and in combination with a separating-table, a delivery-pipe for the material, said pipe having discharge perforations and being mounted in such manner as to be axially movable whereby the perforations may be turned to the desired angle, and an open-bottom loose sleeve upon said pipe.

16. In a concentrator, and in combination with a separating-table, a delivery-pipe for the material, said pipe having discharge perforations and being mounted in such manner as to be axially movable whereby the perforations may be turned to the desired angle, and an adjustable damper-cap or valve at the end of the pipe, to regulate the force of the flow therein.

17. A concentrator comprising a table, means for vibrating it, strips carried by the table and lying transversely above and separated from the bottom of the table, the under faces of said strips being set at an inclination to the surface of the bottom of the table and said strips being uniformly disposed in sets, the inclination of the under faces of the strips in the different sets being different, whereby circulatory currents of given direction are produced in the water upon the said table, substantially as described.

In witness whereof I have hereunto set my hand.

JOHN J. MONTGOMERY.

Witnesses:

WALTER F. VANE,

D. B. RICHARDS.